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ABSTRACT

A review of effective schools studies suggests that the research should continue but the methodology must change if the studies are to gain credibility. The first of this paper's three sections explains the educational production function in terms of the microeconomics of education. The measurement and classification of such function variables as output measures and the characteristics of students, schools, and homes are explained. The second section reviews relevant studies and focuses on the importance of socioeconomic status as a predictor of school achievement. Variations in production functions related to different types of schools are considered. The third section explores problems and issues related to studying productive and effective schools. Methodological weaknesses severely limiting the value of research are noted, with examples drawn from the literature. The paper concludes with suggestions for further research, particularly on the relationship between socioeconomic status and educational achievement. (PGD)

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PRODUCTIVE AND EFFECTIVE SCHOOLS

by

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ABSTRACT

This paper is about productive and effective schools. It is divided into three major sections.

The first section provides an explanation of the concept of the educational production function. In addition, the measurement and classification of variables such as student characteristics, school characteristics, home characteristics, and output measures are explained.

In the second section studies related to the educational production function are reviewed. The importance of socio-economic status is considered as well as some of the attempts to explain the mechanisms by which SES effects achievement. The review of school effects studies includes a consideration of the existence of different production functions for different kinds of schools. The section concludes with a brief exploration of the effective schools research.

The third section of the paper provides an exploration of the problems and issues that relate to the consideration of productive and effective schools. The weaknesses of the available statistical techniques and research designs provide severe limitations to the studies in this field. Furthermore, the literature provides many examples of instances where the consideration of cause and effect might well be logically reversed.

The paper concludes with suggestions for further research in the areas of education production functions and effective schools. In the case of the educational production function, further research into the relationship between socioeconomic status and educational achievement is necessary. The effective schools studies should be continued and expanded but the methodology must be changed if the studies are to gain credibility.

PRODUCTIVE AND EFFECTIVE SCHOOLS

A number of recent studies have examined the relationship between what is done in schools and what those schools produce. The studies have been in areas such as productive schools, school effects, and effective schools. This paper is intended to provide a partial review of the literature in these areas and to provide a perspective upon these kinds of studies. The paper is divided into three major sections. The first section is a review of the microeconomics of schools and educational production. The second section is a review of some of the major studies of educational production. The third section is an attempt to identify the problems and issues that relate to the study of educational production.

THE MICROECONOMICS OF EDUCATION

The microeconomics of education is, at this time, a somewhat ill-defined field of study. Some authors prefer not to deal directly with the microeconomics of education but rather to deal with educational productivity, school effects or even effective schools. Perhaps these topics can be considered different perspectives of the same topic. In general, the terms will be used as synonyms in this paper.

According to Glasman and Biniaminov, educational productivity studies consist of attempts to "identify school inputs which have proven to be significant

determinants of school outputs." They further state that

> Based on the assumption that schools have systems' attributes, these analyses employ research strategies to measure changes in the systems' outputs brought about by changes in the systems' inputs. Production functions are used to reflect the relations between measures of outputs and inputs.(P.509)

In other words, the basic question associated with the educational production function is: How do the resources used in schools (teachers' time, books, space and furnishing, etc.) combine to produce educational outcomes (skills, knowledge, attitudes, etc.)? However, the area is not limited to the above question. Another, frequently asked, related question is: How does the relationship between inputs and outputs vary under different conditions?

The Production Function

Production functions originated with research in industrial processes. In such research it is often possible, through consideration of the technology, to specify a reasonably precise relationship between the items consumed in the process and the products of the process. Even though the mathematics of the production functions can become very complex, the basic idea is fairly simple; namely that the quantities of the various inputs used will determine precisely the quantity of the output. In applying the concept to education, inputs must be identified, outputs must be decided upon and then, through consideration of the process, the relationship must be specified.

As a starting point, perhaps the inputs and outputs of education can be considered in rather global terms. The outputs of education relate to desirable changes in the behavior and attitudes of students. The inputs involve those variables, some in the school and some outside the school, that act to produce those changes in attitudes and behavior. The inputs are seen to include characteristics of the school, the peer group and the home, and of course, characteristics of the student. As a formula, the school production function can be expressed as follows:

IF

O=outputs of education (desirable changes in student attitudes and behavior)

ST=characteristics of the student

SC=characteristics of the school

P=characteristics of the peer group

H=characteristics of the home

THEN

O=f(ST,SC,P,H)

If the mathematical expression of the production function is to be useful, it can not be a simple function. Usually, if the amount of one of the inputs is increased (or decreased) without a change in the other inputs, the output will not increase in direct proportion to the increase in the specific input. In a typical case a one

percent increase in just one input will result in less than one percent increase in the output. Furthermore, most production situations exhibit a condition of declining marginal product. In such a case the continued addition of increments of one input will result in continually smaller increments of output. The Cobb-Douglas production function is the most commonly used mathematical formula for the above situation. Before ever considering a precise mathematical expression, it is necessary to specify the inputs and outputs and the measures of each of them.

Brown and Saks (Review of Research in Education 9, p. 217-254) have considered a number of models of schooling to attempt to determine input and output variables. They start with the simple model of one passive student being taught by one teacher and progress through more complex models to the situation of multiple outputs with groupings of students. They suggest that the following are among the major inputs of education:

1. "Smartness" of teachers.
2. The values held by teachers.
3. The learning curve(s) of students.
4. The time "mix" of individual, small group and large group instruction.
5. Educational aspirations, values and attitudes toward school in the peer group.
6. The availability of appropriate materials.

7. Goals and organization of the school.

8. The appropriate reward structures.

The Outputs

That schools exist to educate students is a simple and widely agreed upon statement. What does this statement mean and how can it be measured? If the above question can be answered, then an output measure for schools has been developed. Unfortunately, the precise meaning of this statement varies significantly among schools and even among classes in the same school. Correctly or incorrectly, the search for a measure of school output has generally been concerned with the identification of some factor common to the goals of most schools and classes or some variable that is seen as correlated to the goals of schools or classes.

In a 1975 survey, Cohn, Milman and Chew found that most of the studies in educational production used achievement, usually in the areas of mathematics and reading, as measures of output. Some of the studies used general tests of achievement like college entrance examinations. A few other studies used measures of a wider range of educational variables.

It is generally conceded that, while achievement in mathematics and reading are among the goals of most schools, they are at best only partial measures of educational outputs. These measures can be improved upon if they are measured in terms of change over a period of time,

usually one year. It is possible to think of situations in which students have gained in educational terms without significant changes in their mathematics or reading achievement. Similarly, it is possible to think of situations in which students have gained little in educational terms even though they have made gains in mathematics and reading. The more comprehensive achievement tests, while covering a broader range of educational goals, suffer similar if lesser limitations.

Cohn cites the work of Mayeske et al as an example of the way in which educational output might be measured. In this work the authors measured schools according to several variables as follows:

1. student's expectation for excellence.
2. student's attitude toward life.
3. student's educational plans and desires.
4. student's study habits.
5. student's achievement.
6. college attendance of former students.
7. vocational school attendance of former students.
8. school drop out rate.

While the above measures would only be useful if the school is the unit of analysis, it provides a sample of the way in which a researcher can use variables that go beyond the usual achievement gains.

Student Characteristics

While Brown and Saks summarize the important characteristics of the student as "the learning curve", this is clearly difficult to define in a measurable way. Consequently, researchers have had to consider the importance of various student characteristics relative to their contribution to learning. In some of the studies the boundaries between student characteristics and other variables, such as characteristics of peers, home and even outputs have become obscure. Keeping in mind that the important student characteristics include those important variables that the student brings to the current situation may help establish the boundaries mentioned above. The student brings the past outputs of the school, the effects of peer group influences and the effects of the home environment to the present school situation. Of course, the student also brings a set of reasonably permanent physical and mental capabilities as well.

The list of important student characteristics might include the following:

1. the measured "intelligence" of the student.
2. previous achievement of the student.
3. previous expectations of the student for further education.
4. attitudes of the student toward school.
5. student "self-concept".

Many of the previous studies, as cited in Glasman and Biniaminov, have used the Locus of Control measure as a proxy for many of the above variables.

School Characteristics

It has been the hope of researchers that this set of variables would be important in the educational production function, since these are the variables most easily controlled by schools. Consequently, there has been a large number of these variables incorporated into the various production function studies. These variables can be divided into subsets such as school district characteristics; physical school plant and equipment; school climate, leadership and policy; characteristics of teachers; and instructional methods and time allocation. A partial list of the school characteristics is as follows:

1. district wealth.
2. district revenues.
3. district size.
4. district location.
5. school size.
6. value of school plant.
7. library and other facilities.
8. value and type of school equipment.
9. school climate (OCDQ).
10. school policies toward achievement.
11. school leadership (LBDQ).

12. liaison with the home (report cards, interviews, etc.).
13. training of teachers.
14. experience of teachers.
15. measured "intelligence" of teachers.
16. teachers teaching assignment and training.
17. time spent on individual vs group instruction.
18. time on task vs organizational time.

The above is a general list of the variables. Some of the research has been aimed at examining the effects of specific resources. In these cases other variables such as the number of computers or the number of specific personnel, etc. have been included in the study.

Peer Groups

Educational sociologists have been concerned about peer group effects upon the education of individual students. Their theories are based on the reaction of students to the attitudes and values of others. Consequently, the variables in this area can become indistinguishable from the student variables referred to earlier. On the other hand many of the student attitudes are developed in the home and neighborhood and thus become tied to "home" variables. The studies that have included peer group variables have used variables that "should" relate to the attitudes and values held by the group. These variables include:

1. The racial mix of the school.

2. The socioeconomic status of the community.
3. The social isolation of the school population.
4. The mix of student attitudes toward learning.
5. Social groupings in the school.

Home Characteristics

Clearly, the home environment can be a major factor in the educational progress of a student. While the educational production studies are concerned with the independent effects of the home, the home conditions and other influences are manifest through student characteristics, such as attitudes and study habits. They are often associated with peer group characteristics and neighborhood effects. Since the student spends such a large amount of time in the home, both before starting school and while attending school, the manifest effects are of major importance. Some studies have attempted to go beyond the value orientation of the home to look at some factors which were expected to determine student achievement in fairly direct ways associated with the student's study time and effectiveness. Some of the home characteristics that have been included in studies are as follows:

1. socioeconomic status.
2. Parents' education.
3. Parents' attitudes toward school.
4. Family possessions.
5. Type of dwelling.

6. Study space.
7. Family size.
8. Assistance with studies.
9. Home location relative to school location.
10. Books and other materials in the home.

STUDIES OF EDUCATION PRODUCTION

This section is intended to provide a partial review of the research in the area of education production. There are many difficulties involved with this research, as will be illustrated in the next section. It is hoped that the difficulties are not so extreme as to negate these studies completely.

The Coleman Report

The report by Coleman, entitled Equality of Educational Opportunity (1966), is worth mentioning even if it is not the most comprehensive work in the area. Coleman's work is considered to be the first large-scale study of the microeconomics of education and is often credited with sparking the interests of other researchers. Furthermore, the Coleman report has been criticized on theoretical as well as methodological grounds.

Coleman collected data on 600,000 pupils in the U.S.A. so as to determine the relationship between school achievement and selected school and non-school variables. He aggregated the data by school district and applied a multiple linear regression model to the data with

achievement as the criterion variable and the school and non-school variables as the predictors. The study reported the non-school variables to be the most important set of predictors of student achievement. Among the non-school variables the socioeconomic status of families in the school district was the best single predictor. Only one school variable, teachers' verbal ability, was weakly associated with student achievement. Coleman concluded that the differences between the schools of various school districts really didn't make any difference in student achievement.

A number of studies, similar to the Coleman study, have followed the Coleman model. Some of the studies, using the Coleman data (Smith, 1968), have come to conclusions quite different from the original study. Other studies, such as those conducted by Hanushek, Thomas, Levin and others, in part, confirm the conclusions of Coleman.

The significant aspect of the studies by Coleman and the similar studies that followed, is not in what they found but rather in what they failed to find. In all of the studies, only about twenty-five percent of the variance in achievement could be accounted for by all of the variables. That is to say, all of the ninety-three variables collected by Coleman and additional variables collected by others are related to only about a quarter of the variance in student achievement. Benson explains the results of these studies as follows:

> A ... problem with educational production studies is that they have been executed largely as fishing expeditions. The process is nothing more than obtaining different kinds of data on large numbers of school children and feeding these into a large computer, hoping all the while that at least some of the variables classified as independent will turn out to be statistically significant in determining student attainment. (1978)

This group of studies has been of consequence in documenting the importance of socioeconomic status in relation to school achievement. Of all the variables in these studies, the only variable that tends to appear consistently related to school achievement is the measure of socioeconomic status. Children from homes of higher socioeconomic status tend to perform better in school than students from homes of lower socioeconomic status. Some of the more recent studies in this field have attempted to determine why socioeconomic status is important in relation to school achievement. Other studies have been concerned with the search for other variables to explain the seventy-five to eighty per cent of the variance in school achievement that was not accounted for in the earlier studies.

Socioeconomic Status

Even before the Coleman report and its conclusive evidence of the importance of the home on learning, there was concern that children, alike in all respects except home background, could perform so differently in school. Educators suggested that perhaps the value orientations

were different; or that the number of books in the home made a difference; or that available study space made a difference and so on. Thomas (1980) suggested that perhaps the use of students' time was an important matter in explaining the differences in achievement among students. While Thomas was mainly concerned with the systematic study of the use of students' time while in school, he recognized that the way in which time was spent at home could have a significant impact upon the educational attainment of a student. Subsequent research has examined this area as a possible explanation for the impact of the home upon school results.

Benson, in an article entitled Household Production of Human Capital: Time Uses of Parents and Children as Inputs, developed four models to explain the relationship between socioeconomic status and school achievement. The four models were as follows:

1. The Parent-Dominant Model. This model is based on the idea that parents of high socioeconomic status spend more time and/or time more supportive of school achievement with their children than do parents of lower socioeconomic status.
2. The School-Dominant Model. This model is based on the idea that school personnel, willingly or unwillingly, behave in such a way as to counteract the effects of some parents. This would have to be particularly true

of parents of high socioeconomic status who have low educational aspirations of their children as well as parents of low socioeconomic status who have high educational aspirations of their children.

3. The Neighborhood-Dominant Model. This model is similar to The School-Dominant Model except that the counteracting force is provided by neighbors and peers rather than school personnel. For example, in a high socioeconomic status neighborhood the positive attitude of neighbors and peers toward education can negate a parent's negative attitude. Similarly, in a low socioeconomic status neighborhood the negative attitude toward education is so strong as to nullify a parent's positive attitude toward education.
4. The Class-Dominant Model. This model differs from The Neighborhood-Dominant Model only in the explanation of the mechanisms at work to produce the result. Here the value systems of the children and the community are such that children from high socioeconomic status homes see education as relevant, appropriate and important while children of low socioeconomic status homes have the reverse set of values. These values may be caused by such things as high unemployment rates, even among relatively well educated persons, in low socioeconomic communities.

Benson conducted a survey of 764 sixth grade students in the Oakland, California public schools. The survey included questions about the socioeconomic status of the home as well as questions about the amount and nature of the time that parents spent with their children. His research was concerned with three questions:

1. Does the availability of parents' time for children vary systematically by SES?
2. Do patterns of parent-child interaction vary systematically by SES?
3. Controlling for SES, do the amounts of time available and the patterns of parent-child interaction appear to have significant associations with school achievement of children?

Benson did not find simple answers to his three simple questions. In attempting to answer question one Benson examined the patterns by SES for both parents and then for mothers alone. He found that the time of both parents fit the pattern expected. The parents in high SES homes spend more time with their children than do parents in low SES homes. However, when he looked at the time mothers spend with their children he found the pattern to be reversed. Mothers in high SES homes spend less time with their children than do mothers in low SES homes.

In order to answer the second question Benson classified the time into the following categories:

1. Cultural activity - working with children on crafts and hobbies, attending an event at the child's school, going to church, going to the library, etc.
2. Household activity - working with the child in the home or yard, buying groceries together, etc.
3. Parent control activity - helping the child do homework, attending to the child's personal needs, putting the child to bed, etc.

Benson found a relationship in the expected direction when considering cultural activities and household activities. He found no relationship between SES and time spend on parent control activities. He further examined the parent control time spent helping the child with homework and found no relationship to SES.

Benson's third question was perhaps the most important. To answer this question he partitioned the data by SES and regressed the time by category against the child's level of achievement. For high SES homes the time spent in cultural activities was positively and significantly related to achievement. The time spent on parent control activities was negatively but not significantly, related to achievement. For middle SES homes the time spent in cultural activities was positively and significantly related to achievement but, while not statistically significant, time spent on parent control activities was positively related to achievement. For low

SES homes there were no significant predictors of achievement although both time spent on cultural activities and time spent on parent control activities were positively related to achievement.

A later study by Benson, Medrich and Buckley came to conclusions that tended to reinforce the conclusions of the earlier study. The authors concluded:

> Our results attributed only a modest amount of power to parent-child interactions in determining school achievement. This is not to say no power. Indeed, specific kinds of behavior (such as "spending time together on weekends") have significant effects on achievement of all children and, most notably, children from low SES families. No group of parents, hence, should regard their efforts toward their children as foreordained to failure. The involved parent is much more likely to prevent low levels of school performance than is the inattentive parent. Nevertheless, even strong commitment toward children does not readily avail the low SES family of any reasonable assurance of high school achievement. If our data indicate that parent power is modest, they attribute a surprising degree of apparent influence to the SES composition of the school. Low SES children appear to be almost literally bouyed up in performance by attending a high income school, even if they receive few parent inputs. Contrarily, low SES children from high input families who attend low income schools do not do well ...

School Effects

A number of studies have attempted to determine the relationship between the variations in school inputs and student achievement. The earlier studies in this area concentrated upon global characteristics like expenditure per pupil, the presence (or absence) of certain facilities such as libraries, science laboratories, etc., the presence

(or absence) or certain programs such as guidance, remedial reading, etc., the age, training and experience of teachers and so on. More recent studies have attempted to examine variables such as classroom processes and the use of class and individual student time in an attempt to explain how the school contributes to student achievement.

The earlier studies of school effects tended to treat schools and pupils as relatively homogeneous in many respects. The studies were a search among variables to find those that made a consistent difference in student achievement. The most striking aspect of these studies, as summarized by Glasman and Biniaminov, is the variations among their conclusions. For example, some studies found class sizes to be positively related to achievement, others found class sizes to be negatively related to achievement while still others found no relationship between the two variables. The relationship between teacher experience and achievement also tended to vary from study to study. It must have been very confusing to anyone trying to make sense of the results of the studies .

Bowles, in a 1970 article entitled Towards an Educational Production Function, provided evidence that the relationship between school (and non-school) inputs and achievement depended upon the nature of the school. He estimated separate production functions for northern and southern (USA) high schools. Three variables (reading

material in the home, teacher's verbal ability score and time spent in guidance) were far more important in southern schools than in northern schools. Conversely, parents' education level was more important in northern schools than in southern schools. This finding suggested that different kinds of schools have different production functions and that resources that make a difference in one setting may have little effect, or even a negative effect, in another setting. Many of the subsequent studies have been aimed at discovering which resources make a difference in a particular setting.

Wendling and Cohen conducted a study of third and fourth grade pupils in 1,021 New York State public schools. They used achievement in reading and mathematics as the dependent variables and teacher characteristics, school characteristics, expenditures and community socioeconomic status as the independent variables. They analyzed the data for the whole state as well as for four identifiable groupings within the state. These groupings were rural schools, downstate schools, upstate non-city schools and upstate metro schools. In another analysis they partitioned the data into high achieving schools and low achieving schools. There were variations in the relationships among the variables between the different groups of schools.

In examining the data for the entire state they found the relationships among the variables to be

consistent with earlier studies. The best predictor of both reading and mathematics achievement was the percentage of minority students in the school. This variable was negatively related to achievement. The other variables, in order of importance, were:

1. percent below poverty line (negatively related to achievement).
2. median years of schooling in the community (positively related to achievement).
3. average experience of teachers (positively related to achievement).
4. expenditures per pupil (positively related to achievement).
5. pupil-teacher ratio (positively related to achievement).
6. number of teachers with an MA or better (positively related to achievement).
7. size of the school (negatively related to achievement).

It should be noted in relation to the above that the last four predictors are not statistically significant predictors of achievement. Thus, the unexpected relationship between pupil-teacher ratio and achievement should not be taken too seriously.

When the data were analyzed by rural, downstate, upstate non-city and upstate metro, there was one surprising departure from the pattern for the entire state.

In the case of rural schools, the median years of schooling in the community was not related to achievement and the percent below poverty line had little association with achievement. This result suggests that socioeconomic status was not an important factor, as a predictor of achievement, in rural schools.

When comparing the characteristics of high and low achieving schools, the results were those generally expected: the percent minority of students was much higher in low achieving schools; the low achieving schools were much larger, perhaps reflecting the data from the New York City schools; and low achieving schools were in low SES areas. However, one difference is hard to explain. The percent of teachers with MA's or better was slightly higher in low achieving schools (65.75%) than in high achieving schools (59.00%).

The identification of different production functions for different kinds of schools has resulted in a new direction in research. This new type of research is referred to as the "Effective Schools" research.

Effective Schools

Rather than search for the relationship between resources and results, as was done in the school effects studies, some researchers have decided to focus their attention upon schools that can be identified as effective.

Once a school has been identified as effective, it is studied in detail in an attempt to determine the cause of its effectiveness. The data gathering has not been limited to quantitative approaches and has often involved rather unstructured observation within the school. Most of the studies of effective schools have been limited to the best schools in the low SES areas of large cities thus the results of the studies may not be applicable to all schools.

The reviews of the research on effective schools indicate a consistency among the findings of the various studies. Effective schools and classrooms in effective schools exhibit certain common, sometimes distinctive, characteristics.

Cohen, in an article entitled Instructional, Management, and Social Conditions in Effective Schools, provides a summary of the literature and research on effective schools. The author classifies the findings into the categories of "effective classroom teaching practices, school-level instructional management and coordination and shared values and culture." Cohen's findings are summarized below.

In relation to effective classroom teaching practices, Cohen found two major categories of concern. These were in the areas of expectations and role definitions and classroom management. Effective teachers

exhibit the following characteristics in relation to expectations and role definitions:

1. they believe that they can have an effect on the achievement of students.
2. they understand and accept responsibility for the content of the curriculum.
3. their classrooms are task-oriented and student progress is monitored. Students are held accountable for their achievement.
4. they expect a high level of achievement from all students, even those students who have performed poorly in the past. They do not dilute the curriculum for slow learners.
5. they treat students differentially by spending more time with the slower students.

Several practices, in the area of classroom management, were attributed to effective teachers. These were:

1. they work to keep the students working on their tasks and are very efficient, in terms of time, in making transitions from one task to another. Student behavior is monitored and corrected.
2. their lessons are prepared in advance and are well structured. Materials needed in teaching are prepared or obtained in advance.
3. students are made aware, early in the term, as to their contributions to an orderly atmosphere. Space and time allocations are clearly explained to them.

4. during the early stages of learning new content much time is spent on oral question and answer sessions, usually involving the entire class. Corrective feed-back is given in a clear and neutral way.
5. they arrange the student assignments such that much of a student's time is spent on activities in which the student can experience a high degree of success.

While Cohen found the research on school-level instructional management and coordination to be at an early stage of development, there appeared to be consistency in the findings related to articulation of programs and principal leadership. In regard to articulation of programs of effective schools, Cohen reported the following:

1. the curriculum content, from grade to grade, is systematic and logical.
2. the school goals are clear and public.
3. the time allocated to different activities is similar in all classrooms.
4. the school has a systematic program of achievement testing. The tests have been selected or designed to be related to the specific learning materials that have been used.

The research on the principal leadership reveals that the principals of effective schools exhibit the following:

1. they can work closely with others, particularly in situations of conflict and ambiguity.

2. they take responsibility for instruction and spend a great deal of their time observing and helping teachers.
3. they minimize classroom disruptions by organizing the provision of supplies and materials. They also develop and help enforce school-wide discipline policies.

Cohen found that a number of studies had examined the shared values and culture of effective schools. The studies that were reviewed indicated that effective schools exhibited shared values and culture in the following ways:

1. teachers worked in a spirit of collegiality. Their work day was characterized by a number of meetings (both formal and informal) to make decisions over common problems in the school.
2. teachers are encouraged (and encourage each other) to improve their teaching practices. Experiments and innovation are common practice.
3. the school has systems of rewards for effective teaching and superior learning. Teachers are given release time to work on innovative practices. Students, who are doing exceptional work, are given recognition.

Perhaps the most attractive aspect of the effective schools approach is the idea that any school can become effective. However, the caution stated earlier in this section should be repeated. The effective schools research involved the best schools among the schools located in the

low SES areas of large cities. The results may not apply to other schools.

EDUCATION PRODUCTION STUDIES: PROBLEMS AND ISSUES

This section is intended to provide a commentary upon the weakness and problems associated with the studies of education production. Many of the studies suffer from the shortcomings of the statistical techniques and research designs used. Studies in this area also suffer from the conceptual problems related to cause and effect considerations.

Statistical Techniques

Many of the earlier studies of educational production used the multiple linear regression model to provide data analysis. This approach has some serious limitations. Some of these limitations have been altered, in later studies, through the use of a "two stage least squares" model.

Multiple linear regression, as used to analyze educational production, has two major weaknesses. The most obvious limitation involves the assumption of a linear relationship between the predictor variables and the criterion variables. In the case of educational production functions researchers have assumed that socioeconomic status, teacher training, peer group variables, and so on are linearly related to student progress. The extent to which the predictors have a non-linear relationship to

student progress, it will not be discovered using multiple linear regression. Some of the researchers have tried to correct for this shortcoming by using a log transformation of the predictor variables. Unfortunately, the log transformation only accounts for one kind of non-linear relationship among an infinite number of possibilities.

The second limitation of multiple linear regression, even with transformations to account for non-linear relationships, is the possibility of "multicolinearily" among the variables. If several of the predictor variables are related to each other and to the criterion variable, then the variance accounted for by each of the predictors can never be known. All of the joint variance will appear to be accounted for by the best single predictor among the variables. For example, if a study had SES of the community and the experience of teachers as predictors of student progress and, if districts with high SES had more experienced teachers, then the best predictor of the two would appear to account for student progress while the other predictor might appear to have no value. Where multicolinearity exists, the variance associated with the better predictors is overestimated while the variance associated with the poorer predictors is underestimated. The Coleman study conclusion regarding the importance of SES has been criticized on this basis.

Researchers have tried to overcome the problem of multicolinearity by using a "two stage least squares" process. This process is intended to remove the joint variance associated with the predictors. Unfortunately, this process changes the nature of the criterion variable and results in underestimating the value of all of the predictors.

Research Designs

The design of many of the educational production function studies has often limited the value of the findings. Some of the design limitations associated with the concepualization and measurement of educational output have already been mentioned in the previous section. The additional limitation in research design results from the choice of the unit of analysis. Aggregation of the data results in "masking" the relationship between predictor and criterion variables.

If the researcher used the school or even the school district as the unit of analysis then the data would be aggregated to that level. Averages would replace actual measures in both the predictors and the criterion. Thus, the average SES of the school or school district, for example, would serve as a predictor of the average student achievement. Obviously, average SES of school districts would vary less than the SES of families. Similarly, the average student achievement of a school district would vary

less than the achievement of individual students. This reduction in the variance of predictors and criterion may work to reduce the apparent relationship between the variables but will never increase it. In studies where anything other than the student has been the unit of analysis, the relationship between the variables has likely been masked as a result of the aggregation of the data.

Cause and Effect

The education production function studies are implicitly based on a cause and effect concept. When Coleman found a strong relationship between SES and achievement, it was assumed that high SES caused superior achievement and low SES caused poor achievement. The models created by Benson were an attempt to explain how the differences in SES could cause differences in achievement. Similarly, in studies that have found that certain characteristics of teachers (experience and verbal ability) are related to achievement, it has been assumed that experienced teachers or teachers with high verbal ability cause students to achieve at a higher level. It is possible to offer alternate explanations with the cause and effect reversed or with at least a circularity of cause and effect.

Benson has offered some explanations as to the way in which differences in SES can cause differences in achievement. However, it is possible to explain a process

by which differences in achievement can "cause" differences in SES. If families of higher SES can afford to consider the school when selecting a home, it is possible that families of higher SES will tend to locate near a school that is known to produce a higher level of achievement. Such a market mechanism would tend to lower the value of homes near schools of lower quality. Families of lower SES would then tend to buy these homes. If the home market worked, at least in part as above, good schools would be surrounded by families of higher SES and poor schools would be surrounded by families of lower SES. If there is a circularity of cause and effect over time then both school achievement and neighborhood SES will continue to increase in one area while a decline would occur in another. The implication of the above explanation is that the process might be halted by improving the schools in lower SES neighborhoods.

Garms et al have examined the relationship between teacher experience and student achievement and have concluded that the cause and effect explanation should be reversed. Most school districts have policies that allow teachers to transfer among the schools of the district. Furthermore, many of the districts allow teachers with the most seniority to have the first refusal of appropriate vacancies. Thus, the most highly experienced teachers can be found in the best schools and the beginning teachers in

the worst schools. Schools with a good record of student achievement should attract the most highly experienced teachers. In a sense, higher pupil achievement can cause the school to have a more highly experienced staff.

It is possible to offer alternate explanations for many of the other findings of the education production function studies. It is important to note that, while the statistical results are consistent with many explanations, the policy implications can be very different. If high SES causes high achievement then the way to improve achievement is to, somehow, improve SES. If the relationship between SES and achievement is more complex, then there may be reason to try to improve achievement by making changes in the school.

Critique on Effective Schools Studies

Articles by Ralph and Fennessey and by Cuban have provided critiques of the effective schools studies. The criticisms tend to focus upon three things:

1. the limited samples of the studies.
2. the lack of systematic measures and the possibility of observer biases.
3. the "cult" nature of the effective schools approach.

As was mentioned earlier, researchers have concentrated upon the best elementary schools in poor neighborhoods. The schools selected for study have been those with higher than average results on student

achievement tests. Schools with one or two outstanding classes or schools with no very poor classes might be selected as effective schools. It is possible that the school has been, mistakenly, credited for the effectiveness that occurs only in a few classrooms and the findings may be meaningless. Even if these schools are truly effective, it may be wrong to assume that the results can be transferred to other levels of schools in other settings. The characteristics of an effective elementary school in a poor neighborhood may be very different from an effective elementary school in a rich neighborhood and may be very different from an effective high school in any neighborhood.

Effective schools have been studied through unstructured observation. Results from these studies can be colored by the perceptions of the observers. Observers can be expected to look for, and even find, those characteristics that they "think" should be present. This might explain why, for example, observers found the effective schools to be task oriented since it is logical that attention to school work should produce better results. Similarly, collegiality, which likely exists in all schools to some degree, was found to be important in effective schools.

There can be another kind of observer effect that may be operating in the effective schools studies. The

staff of a school that has been selected as effective may start to behave in the way that they think an effective school staff should behave without regard to logic or rationality. This behavior brings about the "cult" effect that has been criticized. In a sense, this is the kind of reversal of cause and effect that has been examined earlier. Being an effective school causes the staff to behave in ways associated with the earlier effective schools studies and thus leads to a reinforcement of the earlier findings.

It may be possible to build upon the effective schools studies by selecting from a wider sample and by measuring school and classroom characteristics in a more systematic and unobtrusive manner.

IMPLICATIONS

While many of the implications of the research have been pointed out in the text of this paper, there are some important implications that deserve to be given specific attention. Two of the more important matters that have been considered are the importance of the relationship between socioeconomic status and achievement and the consideration of effective schools.

Many studies have found that SES is an important factor in explaining school achievement. However, researchers seem to be no closer to explaining why or how SES works to produce achievement differences. The fact that

one study found that SES was not an important variable in rural schools may, in some way, be used to begin to explain how this variable works.

The effective schools studies may be highly suspect in many ways, but there is no doubt that some schools are more effective than others. It is important to continue to develop ways to identify, for detailed study, effective, and perhaps, ineffective, schools. Furthermore, the methods used to study these schools will have to be improved. Perhaps a trained group of observers could be used in an adaptation of the "double-blind" research design to provide credible research in this field.

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